

[OCTOBER, 1909.]

p. 951

Progress Report

ON THE

Uganda Sleeping Sickness Camps

FROM

December, 1906, to November 30th, 1908.

BY

A. D. P. HODGES, M.D., Lond.,

Principal Medical Officer, Uganda.



WITH AN APPENDIX

ON

Breeding Grounds of *Glossina palpalis*,

BY

Lieutenant A. D. FRASER, R.A.M.C.,

AND

CLAUDE H. MARSHALL, M.R.C.S., L.R.C.P.



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SLEEPING SICKNESS REPORT.

A review of the work done at the four Sleeping Sickness camps in the Uganda Protectorate up to November 30th, 1908, shows that a total of 5,081 cases had been received and that some 2,000 remained under treatment on that date.

Table I* gives an analysis of the admissions at the various camps since their first opening.

Table II shows the condition of all patients at the end of the year now under review. Tables III to VI show the condition of these cases divided into the stages of the disease in which they were classed on admission.

Tables VII to IX give an analysis of the deaths among all cases which occurred during each month of the second year. These tables show that death continues to thin the ranks, not merely of those admitted during the earliest months, but of such of these as on admission were still in the early stages of the disease. Many of those classed as "improved" in former reports have now succumbed.

Two important questions now arise, namely, whether these camps have up to the present justified their existence and the expenditure incurred in connection with them, and whether their continuance on the same lines is necessary or advisable.

The first of these questions may I think at once be answered in the affirmative.

Although, purely from the point of view of the segregation of an infectious disease and apart from the general preventive measures undertaken, I do not consider that the camps are or have been of any great value, they have been, on the other hand, very useful and necessary adjuncts to the general scheme for the prevention and stamping out of Sleeping Sickness.

They have been of great value as asylums where the sick who have been removed from dangerous areas have found refuge, and where very many persons who would otherwise have been subject to desertion, misery and starvation have been housed, fed and medically cared for.

* Vide p. 6.

They have also been, in my opinion, of considerable educational value.

The fact that hundreds of sick have for long periods been collected in places from which *G. palpalis* is absent, and that the disease has in no case spread either to the attendants or in the neighbourhood, has materially assisted to impress on the natives (a task at first so difficult) the truth of that which they have been taught concerning the connection between the fly and the spread of Sleeping Sickness. They have thus been better able to understand the utility and *bona fides* of the action taken by Government to protect them from infection, and this better understanding has without doubt facilitated the carrying out of preventive measures which might otherwise have been regarded with much suspicion and resentment. An instance of this is the removal of the islanders to the mainland, which, though regarded until lately as impracticable, is now taking place with the full concurrence and assistance of the chiefs themselves.

The camps have also afforded opportunities for the trial on a large scale of the remedies which have been recommended for the cure of human trypanosomiasis. Had these remedies proved successful in any considerable percentage of cases, there is no doubt that practically every case of Sleeping Sickness in the Lake Victoria epidemic area would by now have passed through these camps for treatment. They would still prove of the greatest use for the application of any improved method or remedy which may be discovered in the near future. That the curative results hitherto obtained in Uganda, however, are far from encouraging, remains no longer doubtful, as will be seen from the details given below.

I may say here that it has been stated by the chiefs that, though they think that many less people now have Sleeping Sickness owing to the preventive measures which have been put in force, they do not yet know of any individual among their own people having recovered from the disease, with or without treatment.

The second question, whether the continuance of the camps on the same lines as those on which they are conducted at present is necessary or desirable, is a most important one and for that reason less easily decided.

In my letter of October 20, 1906, in which I recommended the institution of Sleeping Sickness camps, and which appears as Appendix F of the First Half-Yearly Report of the Sleeping Sickness Extended Investigations, I said: "I do not propose that the atoxyl treatment be carried out on the lines of strict scientific investigation and experiment at more than one of these camps, since for this purpose a much larger increase of staff would be required than is here contemplated." My proposal was that one should be an experimental or investigation camp and the rest treatment camps.

The idea of the central investigation camp then put forward was not carried out, but, probably owing to the hopes which were entertained with regard to the curative value of atoxyl, all the camps were eventually formed to run on the same lines as treatment camps. Had a central investigation camp been established, results of considerable scientific value might perhaps have been obtained from the more varied experimental treatment, closer observation of individual cases, and more extensive and minute parasitological study which would thus have been possible. There seems to be no reason to suppose, however, that substantially greater curative results would have

been obtained from the methods of treatment which have been in use hitherto.

The treatment of human trypanosomiasis is still in the experimental stage, and it appears to me that a camp suited for experimental investigation is still desirable, especially for testing new remedies and methods of treatment on human beings and recording the results obtained.

Laboratory experiments on the action of drugs on trypanosomes *in vitro* or in the smaller animals, however carefully carried out, and however important and valuable in themselves, have been less helpful to the medical man in the case of Sleeping Sickness than in that of many other diseases. One of the chief reasons for this I believe to be that the disease in man and in the animals experimented on is so widely different.

In the initial or laboratory experiments with drugs we are dealing with a small animal which is comparatively short-lived, and a disease which is either acute or runs its course very rapidly, which has to be treated within a short time after inoculation or the animal dies, and which, even if retarded by treatment or by idiosyncrasy, scarcely has time during the life of the animal to pass through phases and to cause lesions analogous to those which occur in human trypanosomiasis.

In Sleeping Sickness on the other hand we have a disease which can seldom be treated until a comparatively long time, often many months, has elapsed since infection, and this disease runs either a sub-acute course lasting for months or, more often, a chronic course lasting for years in an animal of comparatively large size whose natural life is of comparatively long duration. Consequently, however valuable may be the facts and indications supplied from the laboratory, the actual testing of the effects of new drugs and treatments on trypanosomes in the human being has to be begun practically *ab initio* in every case.

When our camps were started it was hoped that we had ready to hand a curative remedy which could be given to large numbers of persons in a more or less routine manner; that by the cure of a considerable number of cases material advance would be made towards stamping out Sleeping Sickness; and that the bulk of the scientific work required of Medical Officers would consist in the proper administration of the remedy and the careful and accurate record of results. But this has not proved to be the case.

The remedy in question and its chemical allies have not so far proved to be curative, or only in exceptional cases. New remedies and combinations of remedies are constantly being suggested for trial and varied methods of administration require to be tested, close observation is needed of multiple series of cases under various modes of treatment and also under practically the same conditions as regards climate, food-supply and general hygienic surroundings. In short, there is no longer question of the routine administration to all and sundry of a drug which, it was supposed, might probably effect a cure in a considerable number of cases, but rather of the careful testing of various remedies and methods of administration on series of selected cases, combined with accurate observation and tabulation of results continued over long periods.

For such a purpose I am in favour of a central investigation camp to which all the cases which appear most favourable for treatment should as far as possible be drafted.

Such a camp should be sufficiently staffed to allow ample time to the Medical Officers for varied experiment, close observation both clinical and parasitological of individual cases, and the keeping and reporting of complete and accurate records of progress and results, in addition to their routine duties.

These routine duties, which include the care and treatment of old cases and of those in the more advanced stages; care of lunatics; the general administration, upkeep and food-supply of the camp; and the keeping of books and accounts, at present take up most or all of the time of the Medical Officer in charge. I am therefore of opinion that a constant staff of at least two Medical Officers would be required for an investigation camp such as I recommended.

I would suggest Chagwe camp as being the best suited for the purpose required and Dr. van Someren, now in charge, with Lieut. Fraser, R.A.M.C., who will be released by the closing of Sesse camp, as its Medical Officers. This camp is and would remain in touch with the Royal Society's Commission at Mpumu so long as this Commission is in Uganda, and I would advocate the building of a small laboratory at the camp itself.

Since the camp in the Sesse Islands will soon be closed, the question that remains is, what course it will be best to take with respect to those in Busiro and Busoga.

As has been already mentioned, these camps would be of value as centres for the application of any successful form of treatment which might be discovered in the near future, and I believe that they are still necessary, for the present, as adjuncts to the general scheme of prevention. They are necessary as asylums for the friendless and destitute sick from among those who have been removed from the lake shore and those about to be removed from the islands. Of those already under treatment, apart from the question of keeping complete records of cases, those in the more advanced stages of disease must be retained because they have no other refuge and the less advanced cases because they may still have a chance of being cured. Further, although hitherto segregation in camp has been made voluntary as far as this is possible and consistent with the public safety, circumstances might arise which would render it necessary to make detention compulsory for a far larger number of persons than is the case at present. For instance, it remains to be seen whether the islanders, after their removal to the mainland, will conform as readily to the existing regulations for the prevention of infection as the mainland people have hitherto done.

At Busiro camp (as also at Chagwe) a considerable amount of money has been spent on planting and cultivation in order to secure a permanent local food-supply for the sick and their friends and attendants, and this cultivation has only recently begun to bring in satisfactory returns. In Busoga a long spell of drought, famine and scarcity of labour has prevented any very extensive planting, though a certain supply of food is derived from that which has been done. It has always been hoped that the camps might develop into permanent villages or settlements for such patients as survive and for such of their friends in attendance on them as care to remain or have no other plantations to go to.

Although it is confidently believed that Sleeping Sickness is greatly on the decrease on the mainland, especially in Buganda Kingdom, and that new

infections will be comparatively few, the number of cases remaining in Busoga is still large, and those in Buganda will be temporarily augmented by the introduction of infected islanders. For the next year or two therefore it is not to be expected that the number of admissions to the existing camps will very materially decrease.

I therefore recommend that Busiro and Busoga camps should remain open.

I do not, however, recommend the continued routine use at these camps of expensive drugs and forms of treatment which do not appear likely to effect any considerable number of permanent cures. Such treatment might well be confined to those of the earlier and more suitable cases whom it is found impossible to draft to the central camp. But, though I think that these two camps should be run as economically as possible, I consider that a Medical Officer in charge will still be necessary for their conduct and administration, and that he will need an assistant until such time as his patients materially decrease in number.

I do not recommend at present the establishment of any new camps on the lines of existing ones. It may become necessary to place a small observation camp somewhere in Buddu, in connection with the control of native traffic near the German boundary, but infected cases in South Buddu appear to be now so few, and the traffic already so restricted, that at the moment it seems probable that a post of observation at Masaka will meet all requirements.



TABLE I.
Showing Monthly and Quarterly Admissions to each Camp from
December 12th, 1906, to November 30th, 1908.

	Busiro.		Kyagwe.		Busu.		Sesse.		Totals.	
	Month.	Quarter.	Month.	Quarter.	Month	Quarter.	Month.	Quarter.	Month.	Quarter.
December, '06	136								136	
January, '07	71								71	
February	41	248							41	248
March	78								78	
April	41								41	
May	32	151							32	151
June	24								24	
July	28								28	
August	28	80	82	82	16	16			126	178
September....	16		84		47				147	
October	16		110		175				301	
November	10	42	50	244	100	322			160	608
First year's totals....		521		326		338				1,185
December, '07	53		86		221		219		579	
January, '08	40		75		207		369		691	
February	50	143	31	192	110	538	251	839	442	1,712
March	47		33		123		77		280	
April	37		25		71		159		292	
May	17	101	47	105	67	261	83	319	214	786
June	26		39		177		28		270	
July	13		45		175		227		460	
August	26	65	40	124	43	395	14	269	123	853
September....	18		27		68		6		119	
October	19		34		214		7		274	
November	15	52	23	84	101	383	13	26	152	545
Second year's totals		361		505		1,577		1,453		3,896
Aggregate		882		831		1,915		1,453		5,081

TABLE II.
Showing condition of all Patients of each Camp on November 30th, 1908.

Condition on November 30th, '08.	Busiro.	Kyagwe.	Bussu.	Sesse.	Totals.
Improved	28	269	191	178	666
Relapsed	87	46	72	58	263
In statu quo	209	102	393	83	787
Absent	85	154	190	920	1,349
Died	473	260	1,069	214	2,016
Totals	882	831	1,915	1,453	5,081

TABLE III.

Showing condition of all* A Cases at each Camp on November 30th, 1908.

Condition on November 30th, '08.	Busiro.	Kyagwe.	Bussu.	Sesse.	Totals.
Improved .... .... ....	....	24	7	14	45
Relapsed	35	3	19	11	68
In statu quo	22	23	67	34	146
Absent	37	32	37	236	342
Died	28	10	91	14	143
Totals....	123	91	221	309	744

*Vide p. 27.

TABLE IV.

Showing condition of all B Cases at each Camp on November 30th, 1908.

Condition on November 30th, '08.	Busiro.	Kyagwe.	Bussu.	Sesse.	Totals.
Improved	4	121	135	104	364
Relapsed	49	22	49	45	165
Continued in same state	154	44	237	37	472
Absent	40	75	109	574	798
Died	197	71	591	64	923
Totals....	444	333	1,121	832	2,722

TABLE V.

Showing condition of all C Cases at each Camp on November 30th, 1908.

State on November 30th, '08.	Busiro.	Kyagwe.	Bussu.	Sesse.	Totals.
Improved	20	114	45	53	232
Relapsed	3	21	4	2	30
Continued in same state	32	35	87	9	163
Absent	7	47	43	99	196
Died	157	140	334	63	694
Totals....	219	357	513	226	1,315

TABLE VI.

Showing condition of all D Cases at each Camp on November 30th, 1908.

State on November 30th, '08.	Busiro.	Kyagwe.	Bussu.	Sesse.	Totals.
Improved	4	7	4	10	25
Relapsed .... .... ....	....	....	....	....	....
Continued in same state .... .... ....	....	1	4	1	6
Absent	1	....	1	11	13
Died	94	39	55	68	256
Totals	99	47	64	90	300

TABLE VII.

Showing Month of Death and Month of Admission of all Cases which Died in Camp during the Second Year.

Month of Admission.	Month of Death.												Totals.
	Dec., '07.	Jan., '08.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	
Deeember, '06	8	....	2	2	2	9	....	1	....	....	1	1	26
January, '07	2	4	2	2	2	....	2	....	....	2	1	....	17
February....	1	1	2	3	2	3	1	....	....	....	....	....	13
March	3	....	1	3	2	3	4	3	2	....	2	1	24
April	1	3	2	1	2	4	1	....	1	1	....	....	15
May	1	2	1	1	1	1	....	1	2	1	1	....	12
June	1	....	1	1	3	2	3	....	1	....	....	....	12
July ....	....	2	2	3	2	1	2	3	....	2	....	2	19
August	7	9	8	3	5	8	9	6	3	5	2	5	70
September	10	5	6	5	8	7	5	3	2	6	4	2	63
October	28	17	17	17	7	13	12	9	8	8	6	2	144
November	25	11	15	15	11	7	6	1	2	3	1	2	99
Deeember	28	23	33	33	30	19	22	15	14	15	16	5	253
January, '08 ....	....	18	52	42	27	25	13	10	10	11	8	7	223
February....	....	....	9	36	23	14	9	11	14	11	8	8	143
March ....	....	....	....	13	24	16	18	18	4	1	2	3	99
April ....	....	....	....	....	11	28	13	10	6	4	6	3	81
May ....	....	....	....	....	....	32	20	9	4	6	3	4	78
June ....	....	....	....	....	....	....	69	54	11	3	3	5	145
July ....	....	....	....	....	....	....	....	69	47	24	12	6	158
August ....	....	....	....	....	....	....	....	....	5	12	2	2	21
September ....	....	....	....	....	....	....	....	....	....	11	10	1	22
October ....	....	....	....	....	....	....	....	....	....	....	23	25	48
November ....	....	....	....	....	....	....	....	....	....	....	11	11	11
Totals	115	94	153	180	162	192	209	223	136	126	111	95	1,796

TABLE VIII.

Showing Month of Death and Month of Admission of all A Cases who Died in Camp during the Year.

Month of Admission.	Month of Death.												Totals.
	Dec., '07.	Jan., '08.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	
December, '06	1	...	1	1	...	1	...	...	...	...	...	...	4
January, '07	1	1	...	...	...	...	...	...	...	...	...	...	2
February....	...	...	1	1	...	1	...	...	...	...	...	...	1
March ....	...	...	...	...	...	...	...	...	...	...	...	...	2
April ....	...	...	...	...	...	...	...	...	...	...	...	...	...
May ....	...	...	...	...	...	...	...	...	...	...	...	...	...
June ....	...	...	...	...	...	...	1	...	...	...	...	...	...
July ....	...	...	...	...	...	...	1	...	...	...	...	1	1
August ....	...	1	...	...	...	...	...	...	1	1	...	...	1
September	1	...	...	...	...	...	...	...	1	1	...	...	3
October ....	...	...	1	...	...	...	2	...	2	...	...	...	5
November ....	...	...	1	...	...	...	...	...	1	...	1	1	4
December	1	2	2	1	3	3	2	1	1	3	4	1	22
January, '08	1	1	1	3	3	2	1	...	3	...	...	...	14
February....	...	...	2	...	1	2	...	...	...	...	...	...	5
March ....	...	...	...	...	2	1	4	3	...	...	...	...	10
April ....	...	...	...	...	...	...	2	2	...	...	...	...	4
May ....	...	...	...	...	...	...	...	1	...	1	1	...	3
June ....	...	...	...	...	...	...	5	9	1	...	...	...	15
July ....	...	...	...	...	...	...	...	13	7	6	3	2	31
August ....	...	...	...	...	...	...	...	...	...	...	...	...	...
September ....	...	...	...	...	...	...	...	...	...	...	...	...	...
October ....	...	...	...	...	...	...	...	...	...	...	...	3	3
November ....	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	4	4	9	6	9	8	16	29	18	12	6	9	130

TABLE IX.

Showing the Month of Death and Month of Admission of B Cases who Died in Camp during the Year.

Month of Admission.	Month of Death.												Totals.
	Dec., '07.	Jan., '08.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	
December, '06	5	...	...	...	2	4	...	...	...	...	1	1	13
January, '07	1	2	2	2	2	...	2	...	...	1	...	...	12
February....	1	1	1	2	1	1	1	...	...	...	...	...	8
March	3	...	...	2	1	2	4	3	2	...	2	1	20
April	1	3	1	1	2	3	1	...	1	...	...	...	13
May ....	...	1	1	1	1	...	...	1	2	...	1	...	8
June	1	...	1	1	3	2	3	...	1	...	...	...	12
July ....	...	...	...	1	...	...	...	2	...	...	...	2	5
August	1	2	4	2	3	5	4	2	1	2	1	3	30
September ....	...	2	5	1	1	1	1	1	...	3	3	...	18
October	2	...	11	9	2	5	4	3	5	7	3	1	52
November	8	5	7	4	8	5	3	...	1	...	1	...	42
December	5	18	27	23	16	13	17	10	6	9	9	3	156
January, '08 ....	...	2	20	21	15	13	7	9	5	4	4	3	103
February....	...	...	4	8	11	7	4	5	4	6	4	4	57
March ....	...	...	...	1	2	8	12	8	4	1	1	1	38
April ....	...	...	...	...	4	13	10	7	4	1	5	1	45
May ....	...	...	...	...	...	17	15	5	2	4	...	1	44
June ....	...	...	...	...	...	...	44	34	7	1	2	5	93
July ....	...	...	...	...	...	...	...	34	26	11	4	4	79
August ....	...	...	...	...	...	...	...	...	1	3	1	1	6
September ....	...	...	...	...	...	...	...	...	...	2	4	1	7
October ....	...	...	...	...	...	...	...	...	...	...	6	13	19
November ....	...	...	...	...	...	...	...	...	...	...	...	4	4
Totals	28	36	84	79	74	99	132	124	71	56	51	50	884

In summing up, in my introduction to Capt. Gray's report for the quarter, December, 1907, to February, 1908, the situation with regard to atoxyl as it then appeared I wrote as follows :—

- “ 1. In most cases there is temporary improvement from its use.
- 2. There is probably in most cases prolongation of life.
- 3. In all cases which may come in contact with the fly there is diminution of their infectivity.
- 4. There are still considerable numbers of original A and B cases who are still alive and these may be eventually cured.
- 5. The results from atoxyl and mercury are at present promising and may prove to be more lasting than those from atoxyl alone.
- 6. Experience has been gained in the use of the drug, the supply is now constant and it is to be hoped that the quality will improve yet further.
- 7. We have at present no other treatment apart from atoxyl and its allies which has shown any sign of successful results.”

In comment on the above and in regard to the present position I would now say :—

1. The improvement which occurs in many cases has not been maintained in the great majority of them.
2. The prolongation of life which results has been of no benefit to the community and of at least doubtful benefit to the patients themselves.
3. Where the measures taken for preventing contact of the sick with the fly are practically complete, as in the Victoria Nyanza epidemic area, the diminution of infectivity produced by atoxyl treatment is of little value.
4. The number of early cases which have maintained their improvement has steadily decreased and the number of persons likely to be permanently cured is now inconsiderable.
5. The results obtained from atoxyl and mercury do not at present seem any more likely to be permanent than those obtained from atoxyl alone.
6. Increased experience in the use of organic arsenical remedies, combined with their practically constant supply in a chemically pure condition, has not up to the present brought about any corresponding rate of improvement in statistics.
7. It remains true that better results have been obtained from treatment with organic arsenic, alone or combined with other drugs, than from any other method.

I would add that the measure of success obtained justifies perseverance in searching for improved drugs, especially organic arsenic and perhaps also antimony compounds, and for improved methods for their administration, especially in conjunction or alternation with inorganic arsenic and antimony ; but there is little encouragement for perseverance in our present methods (as herein reported on) of the routine administration of organic arsenic to all cases of Sleeping Sickness for prolonged periods.

Of the two sepoys mentioned in my introduction to Capt. Gray's report above-mentioned, Ladha Singh is in good health and apparently well, while Narain Singh, though in fairly good health, is stated to become occasionally drowsy and cannot be regarded as cured, though he may be free from infection. Both cases were originally treated with inorganic arsenic and received organic arsenic only late in the course of the disease.

Copies of reports on the above two cases which were sent to the Indian Government in December, 1908, are here attached.

At the time of writing it is over 4 years since trypanosomiasis was discovered in these men and their condition remains practically the same as recorded in the reports. Neither of them has received any further treatment.

Trypanosomes were last found in Ladha Singh in March, 1906, and in Narain Singh in March, 1907.

Since several of the most old-standing apparent cures of Sleeping Sickness have been treated entirely or almost entirely with inorganic arsenic in solution this would seem to be an argument for returning to this form of administration, in suitable cases, in conjunction with organic arsenic or other drugs.

NARAIN SINGH, SEPOY, 4TH KING'S AFRICAN RIFLES.

General Condition.

Very good. Is strong and well nourished, not anaemic. No tremors of tongue or hands.

Reflexes normal. Moderate enlargement of spleen.

Cervical Glands.

Several glands moderately but distinctly enlarged. No trypanosomes found on puncture.

Blood.

No trypanosomes found in thick films. Differential count shows great relative increase of lymphocytes.

		%
Polymorphonuclear leucocytes	....	23.5
Lymphocytes	....	70.5
Large mononuclear leucocytes	....	6
Eosinophile leucocytes	....	0
		<hr/> 100.0

(Sd.) H. B. OWEN, Medical Officer, Civil Hospital, Entebbe.

Last specific treatment for Sleeping Sickness.

Kharsin, 2 injections, May, 1908.

(Sd.) A. D. P. HODGES, Principal Medical Officer, Uganda.

LADHA SINGH, SEPOY, 4TH KING'S AFRICAN RIFLES.

General Condition.

Very good, is strong and well nourished. No anaemia. No tremors of tongue or hands.

Reflexes normal. Spleen normal.

Cervical Glands.

Slight enlargement of a few glands, these being rather hard.

On puncture no trypanosomes found.

Blood.

No trypanosomes found in thick films. Differential count shows a relative increase of lymphocytes, and of large mononuclear lymphocytes and eosinophile cells to slight extent.

		%
Polymorphonuclear leucocytes	....	31.0
Lymphocytes	....	46.9
Large mononuclear leucocytes	....	14.4
Eosinophile leucocytes	....	7.7
		<hr/> 100.0

(Sd.) H. B. OWEN, Medical Officer, Civil Hospital, Entebbe.

Last specific treatment for Sleeping Sickness.

Atoxyl, 2 injections, April, 1907.

(Sd.) A. D. P. HODGES, Principal Medical Officer, Uganda.

In estimating the curative effects of treatment, however, we must place against such cases of apparent cure as Sepoy Ladha Singh the fact that trypanosomiasis has been known to last for years, and to remain more or less quiescent in human beings without any treatment.

Cases of Sleeping Sickness which occurred in the West Indies among the slaves imported from Africa are probably instances of this, since those slaves were not only in sufficiently good health when captured to withstand the severe hardships and the frightfully insanitary conditions usual in slave ships, but some of them actually worked for years in the West Indies before succumbing to the disease.

The following case reported by Dr. C. J. Baker is an example of what may occur. Such cases are probably rare, but so also, unfortunately, are apparent cures.

It will be seen that some 4 years after the discovery of trypanosomes in his blood, and without treatment, the man reported on still remained in an apparently early stage of trypanosomiasis, which throughout the whole period has been, so far as can be ascertained, practically latent.

An important difference between this case and those of apparent cure is that trypanosomes were found, whereas it is on account of the absence of trypanosomes from cases apparently cured by treatment that we hope that the cures may prove permanent. It is discouraging, however, to remember that such cases have eventually died of Sleeping Sickness without our having been able to demonstrate any recurrence of trypanosomes.

CASE REPORTED BY DR. C. J. BAKER.

On January 1st of this year one of the officers of the King's African Rifles at Bombo mentioned to me that he had seen the word "Trypanosome" written on the defaulter sheet of a man who had, the day before, taken his discharge as his term of service had expired.

I asked to see the man and the defaulter sheet and on the latter I found written in pencil, "Trypanosomes found in blood June, 1905" (no signature).

I found the man—a Munyamwezi—had typical enlarged cervical glands, which on examination proved to contain trypanosomes.

Though his expression was somewhat dull, he otherwise appeared to be in good health, and had no tremors or other early signs, and did not complain of headache nor of sleeping in the day time.

He remembered being ill for a short time at Jinja. Dr. Densham was Medical Officer at Jinja at the time.

The probability is that he had no trypanocidal treatment, as at that time the Sleeping Sickness camps had not been organised, and I could find no record of his being sent to Entebbe and the man stated that he had had no injections of any kind while attending the dispensary at Jinja.

Searching inquiries from the man himself and from the Non-Commissioned Officers and men of his company as to whether he slept in the day time proved negative, nor could I discover that he had ever been off duty for sickness since the date mentioned.

Since June, 1905, his company had been stationed at Jinja, Hoima and Mbarara and had been engaged in two military expeditions.

I sent the man with particulars to Buwanuka Sleeping Sickness camp and noted the fact of his having trypanosomiasis on his discharge papers.

I have the honour, &c., &c.,

(Sd.) C. J. BAKER, M.O., Kampala.

Speaking generally of the effects of treatment, it must be said that atoxyl and its allies, though possessing a marked, if transitory, trypanocidal action, have not proved to be suitable for routine administration to all classes of cases, and that no considerable number of cures can be expected to result from their administration by the methods hitherto in use. But it cannot fail to be noticed, by those who have been familiar with the natural course of Sleeping Sickness before the use of modern remedies, that this course is, if not cut short, at any rate considerably modified by the administration of the organic compounds of arsenic.

Paralysis, paresis, and epileptiform convulsions, which among untreated cases occurred in a small percentage, are now commonly met with, and are often the precursors of sudden death, which itself was very exceptional before the use of organic arsenic. Sudden or rapid death, in fact, generally preceded by cerebral symptoms, would appear now to be almost the rule among such cases as have received full courses of organic arsenic, while the prolonged lethargic stage which almost invariably marked the end of untreated cases is either scarcely noticeable or absent.

It would seem probable therefore that, owing to the prolongation of the course of the disease by treatment, the nervous lesions are afforded time to become more pronounced and eventually to kill the patient, and that this may happen even though all trypanosomes may have been eliminated from the system.

If this be so, and these nervous lesions are in no way due to the treatment itself, it of course follows that, when once the disease has reached a certain stage, the lesions then existing are likely to be progressive, apart from the toxins produced by trypanosomes, and that treatment by trypanocidal drugs during or after that stage will probably be useless.

When this stage actually occurs is not known, and it is doubtful whether there would be any clinical symptoms by which it could be recognised, though it has long been agreed that it is necessary to begin treatment at as early a stage as possible.

Unfortunately from the point of view of treatment, admissions of early cases tend to diminish in number at the older-established camps, and it is expected that, owing to the preventive measures taken, such admissions will continue to become more rare in the Victoria Nyanza epidemic area.

In reviewing in detail the results of treatment at the camps it will be well first to follow the history of the cases admitted during the first year, December 12th, 1906, to November 30th, 1907, and afterwards to consider that of these admitted during the second year, December 1st, 1907, to November 30th, 1908.

In this report it will be seen that the number 1,185 is substituted for the number 1,135 given in previous reports for the total of admissions during the first year. The total 1,185 includes all cases entered on the books with all deserters and absentees. Apparently some of the deserters have from time to time returned to camp, and the correction is necessary in the present report in order to follow out the statistical history satisfactorily.

In connection with the absentees, of whom a large proportion appear on many of the tables, it is probable that the majority of them among the older admissions and among the admissions during the later stages of disease have died.

In regard to absentees generally, with the exception of these comparatively few cases who obtain leave of absence from time to time between courses of treatment, it may be taken that it is chiefly those who have not benefited by treatment who do not return, and that the death rate has been at least as high among them as among the cases remaining under observation in camp. A considerable number of absentees are islanders who have come or been sent for treatment and, after a shorter or longer interval, have escaped back to their islands and have been no more heard of.

As has already been mentioned, attendance or residence at camps has remained in a great measure voluntary, but all deaths and desertions and all cases of absence, with or without leave, are notified at once to the local chief to whose village or estate the patient belongs, and every precaution is taken against the return of infected persons to the neighbourhood of fly-areas.

The following tables, X to XXVIB, relate to cases admitted during the first year.

TABLE X.

Showing State of First Year's Admissions at Various Dates.

Condition.	On Nov. 30th, '07.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	517	292	168	137
Relapsed	77	94	134	49
Continued in same state	284	287	137	129
Absent	87	181	180	201
Died	220	331	566	669
Totals	1,185	1,185	1,185	1,185

TABLE XI.

Showing State of First Year's A Cases at Various Dates.

Condition.	On Nov. 30th, '07.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	88	43	27	19	12
Relapsed	16	8	11	4	16
Continued in same state	18	53	21	25	21
Absent	13	22	53	56	50
Died	5	14	28	36	41
Totals....	140	140	140	140	140

TABLE XII.

Showing State of First Year's B Cases at Various Dates.

Condition.	On Nov. 30th, '07.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	266	149	88	76	38
Relapsed	44	46	86	32	36
Continued in same state	126	152	66	69	77
Absent	37	70	83	100	90
Died	44	100	194	240	276
Totals....	517	517	517	517	517

TABLE XIII.

Showing State of First Year's C Cases at Various Dates.

Condition.	On Nov. 30th, '07.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	156	95	47	41	34
Relapsed	14	37	34	13	12
Continued in same state	134	77	54	31	18
Absent	11	63	38	43	41
Died	116	159	258	303	326
Totals....	431	431	431	431	431

TABLE XIV.

Showing State of all First Year's D Cases at Various Dates.

Condition.	On Nov. 30th, '07.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	7	5	7	1	4
Relapsed	3	3	4	....	....
Continued in same state	6	5	....	4	1
Absent	26	26	....	2	1
Died	55	58	86	90	91
Totals....	97	97	97	97	97

TABLE XV.

Showing Percentage of Improvement and Death Rate among Early and Late Cases at Various Dates.

	On Nov. 30th, '07.		On Feb. 29th, '08.		On May 31st, '08.		On Aug. 31st, '08.		On Nov. 30th, '08.	
	Early.	Late.	Early.	Late.	Early.	Late.	Early.	Late.	Early.	Late.
	%	%	%	%	%	%	%	%	%	%
Percentage of improvement	53	30	28	18	17	10	14	7	7	7
Percentage of deaths	7	32	17	41	32	63	42	72	48	79

TABLE XVA.

Showing Percentage of Improvement and of Deaths among First Year's Cases on November 30th, 1907, and November 30th, 1908.

	On Nov. 30th, '07.			On Nov. 30th, '08.		
	A Cases.	B Cases.	All Cases.	A Cases.	B Cases.	All Cases.
	%	%	%	%	%	%
Improved	62.8	51.4	45	8.5	7.3	7.4
Deaths	3.5	7.3	19	30	53.3	62

Referring to tables X and XVA it will be seen that in the course of a year "Improved" cases have diminished from 517 or 45% to 88 or 7.4%, while deaths have increased from 220 or 19% to 734 or nearly 62%. It can also (12124)

be seen from table X. that whereas 878 cases were known to be alive on November 30th, 1907, only 269 were known to be alive on November 30th, 1908.

Tables XI to XV_A, in which cases are classed according to the stage of disease on admission, show the same discouraging trend of events.

Amongst A cases those marked "Improved" have decreased during the year from 88 or 62.8% to 12 or 8.5%, while deaths have increased from 5 or 3.5% to 41 or 30%.

Improved B cases have decreased from 266 or 51.4% to 38 or 7.3%, while deaths have increased from 44 or 8.5% to 276 or 53.3%.

Improved C cases have decreased from 36.1% to 7.8%, and deaths have increased from 26.9% to 75.6%.

Though a few D cases are still classed as improved from their original condition the death rate among them is rapidly approaching 100%.

Against 122 A cases known to be living on November 30th, 1907, there were but 49 a year later. Against 436 B cases known to be living on November 30th, 1907, there were 151 a year later. Against 304 C cases known to be living on November 30th, 1907, there were 64 a year later.

The greatest decrease in improvement rate and corresponding increase in death rate is seen among the earlier (A and B) cases, so that the percentages tend to equalise for all cases as time goes on, the percentages of improvement being already practically equal at the end of 2 years. In fact, from table XXVI it would appear that the percentage of improvement is likely to approach to vanishing point at the end of 2 years. From this last table it will be seen that on November 30th, 1908, out of 399 cases admitted before May 31st, 1907, only one is reported as improved (from C to B stage) and only 78 were known to be alive, 54 of whom are classed in the same stage as on admission. A list of the survivors in camp on November 30th, 1908, follows here in table XXVI_A.

TABLE XXVI.

Showing condition on November 30th, 1908, of all Classes of Cases admitted during the 6 Months ending May 31st, 1907, *i.e.*, after 1½ Years or more.

		A.	B.	C.	D.	Totals.
Improved	....	....	....	1	....	1
Relapsed	....	....	11	12	....	23
Continued in same state	....	10	42	2	....	54
Absent	....	....	27	22	1	50
Died	....	....	17	111	90	53
Totals....	....	65	187	94	53	399

Of the above 11 cases were treated with atoxyl and mercury, all of whom died. The rest were treated with atoxyl.

TABLE XXVIA.

List of patients surviving from the 399 admitted during the first 6 months (December 12th, 1906, to May 31st, 1907) showing class of case on admission, treatment, condition on November 30th, 1908, &c.

No.	Class.	Name.	Date of Admission.	Examina-tion for Trypanosomes.	Apparent cure.	? A, B, C or D. Present Stage.	Atoxyl Grms.	System.	Duration of Treatment.
1301	B	Wakalo	.... 12.12.06	Neg. blood....	No	B	9	A	11
1302	B	Elimya	.... 12.12.06	" "	No	D	12	A	9
1312	B	Mutagwanya	.... 12.12.06	" "	No	B	11.2	A	11
1320	B	Yowana	.... 12.12.06	" "	No	B	9.4	A	12
1321	B	Malyabe	.... 12.12.06	" "	No	B	10.4	A	11
1322	B	Bwekilo	.... 12.12.06	Not tested....	{ Dying No }	D	9.4	A	11
1323	B	Bukuku	.... 12.12.06	Neg. blood....	No	B	8.3	A	11
1327	A	Namukobe	.... 12.12.06	Away on leave	No	A	5.4	A	5
1335	C	Eliya	.... 12.12.06	Away on leave	No	B	13.8	A	10
1337	B	Sabawewa	.... 12.12.06	Not tested....	{ Dying No }	D	10.8	A	9
1342	C	Adamu	.... 13.12.06	Neg. blood....	No	C	11.4	A	10
1355	B	Yagenda	.... 16.12.06	On leave	No	B	8.4	A	12
1356	B	Sabakaki	.... 16.12.06	Neg. blood....	No	B	8.4	A	7
1358	A	Bailuno	.... 16.12.06	Neg. glands	No	B	7.8	A	7
1362	B	Yacobo	.... 17.12.06	Neg. blood....	No	B	12.5	A	11
1366	B	Namatede	.... 17.12.06	" "	No	B	7.5	A	11
1370	B	Iphraim	.... 18.12.06	" "	No	B	12.6	A	9
1376	A	Bagenda	.... 19.12.06	" "	No	B	7.8	A	6
1379	B	Zou	.... 19.12.06	" "	No	B	7.6	A	7
1386	C	Thenansi	.... 19.12.06	" "	No	C	11.4	A	10
1387	A	Mirani	.... 19.12.06	" "	No	B	0.9	A	5
1388	A	Ziria	.... 20.12.06	" "	No	A	5.4	A	5
1392	A	Busuwe	.... 22.12.06	" "	No	B	10.2	A	9
1397	A	Zerida	.... 24.12.06	Neg. glands	No	A	11.4	A	10
1400	A	Andereya	.... 24.12.06	" "	No	B	12.6	A	9
1404	B	Isaiah	.... 24.12.06	Neg. blood....	No	B	10.9	A	10
1405	B	Wainutalagwe	.... 24.12.06	" "	No	D	7.2	A	7
1409	B	Koi	.... 26.12.06	Neg. gland....	No	C	10.4	A	7
1412	B	Anasiti	.... 27.12.06	Neg. blood....	No	B	10.3	A	7
1415	A	Yokana	.... 28.12.06	" "	No	A	7.2	A	11
1416	B	Amusi	.... 28.12.06	Neg. glands	No	B	12.4	A	9
1417	B	Tebogelakwo-mu	.... 28.12.06	" "	No	B	12.2	A	9
1424	B	Njera	.... 29.12.06	" "	No	B	12.2	A	11
1426	B	Samayiri	.... 29.12.06	Neg. blood....	No	C	7.8	A	6
1427	B	Gerasoni	.... 29.12.06	" "	No	B	9.4	A	12
1428	B	Antuani	.... 29.12.06	" "	No	B	12.6	A	10
1429	B	Zawaya	.... 29.12.06	" "	No	B	10.7	A	7
1431	A	Makumbwe	.... 31.12.06	Away	?	A	7.2	A	8½
1434	B	Asoni	.... 31.12.06	Neg. blood....	No	B	5.4	A	4
1393	B	Lugwana	.... 3. 1.07	Away	?	B	5.4	A	6
1451	B	Vedenego	.... 4.1.07	Neg. blood....	No	C	10.6	A	7
1460	B	Thomas	.... 7.1.07	Neg. glands	No	B	10.2	A	7
1465	B	Twavidana	.... 8.1.07	" "	No	B	3.6	A	4
1474	B	Sefuia	.... 11.1.07	Neg. blood....	No	B	4.6	A	13

TABLE XXVI A—continued.

List of patients surviving from the 399 admitted during the first 6 months (December 12th, 1906, to May 31st, 1907) showing class of case on admission, treatment, condition on November 30th, 1908, &c. continued.

No	Class.	Name.	Date of Admission.	Examination for Trypanosomes.	Apparent cure.	? A, B, C or D. Present Stage.	Atoxyl Grms.	System.	Duration of Treatment.
1480	B	Musubika	15.1.07	Neg. blood....	No	C	11.5	A	11
1484	B	Mundu	15.1.07	„ „ „	No	B	12.6	A	12
1485	B	Mukoza	15.1.07	„ „ „	No	B	11.9	A	12
1496	B	Katenda	18.1.07	„ „ „	No	B	7.2	A	13
1201	B	Lusansa	24.1.07	„ „ „	No	B	4.8	A	13
1202	A	Daudi....	24.1.07	„ „ „	No	A	5.8	A	13
1204	A	Malita	25.1.07	Away	?	A	7	A	12 ¹
1215	A	Bagunwa	12.2.07	Neg. blood....	No	B	6	B	5
1216	A	Mwanika	13.2.07	„ „ „	No	B	5	B	5
1217	B	Kobeja	13.2.07	Neg. gland....	No	C	6	B	5
1226	A	Yatua....	17.2.07	„ „ „	No	A	5	B	5
1227	A	Nsange	17.2.07	„ „ „	No	A	5	B	5
1228	A	Nasaza	17.2.07	„ „ „	No	B	6	B	5
1230	A	Yobo	17.2.07	„ „ „	No	A	6	B	5
1235	A	Mutibwa	17.2.07	Not tested	{ No Dying }	D	11	B	10
1237	B	Maliya	19.2.07	Neg. glands	No	B	5	B	5
1238	B	Sabca....	19.2.07	„ „	No	B	5	B	5
1240	A	Tabita	21.2.07	„ „	No	B	6.3	B	12
1248	C	Kamira	27.2.07	Neg. blood....	No	C	9	B	9
1262	A	Kabaseke	7.3.07	„ „ „	No	A	3.3	B	2
1274	B	Kayaga	9.3.07	„ „ „	No	B	9.2	B	10
1281	B	Petero	10.3.07	„ „ „	No	B	3.4	B	2
1298	B	Gamiyuka	14.3.07	Not tested	{ No Dying }	D	10.4	B	9
409	B	Boladina	24.3.07	Neg. blood....	No	B	10.1	B	11
421	B	Ziriaulao	28.3.07	Neg. gland....	No	B	7.6	B	11
422	B	Sala	28.3.07	„ „ „	No	B	7.6	B	11
424	B	Sabakaki	29.3.07	„ „ „	No	B	6.4	B	10
431	B	Yacobo	2.4.07	Neg. blood....	No	B	12.2	C	7
432	B	Damali	2.4.07	„ „ „	No	B	9.8	C	4
433	B	Petero	3.4.07	Neg. gland....	No	B	10.9	C	8
435	B	Katetemera	4.4.07	„ „ „	No	B	9.7	C	9
442	B	Sabakaki	6.4.07	„ „ „	No	B	11.2	C	7
		Josiah							
601	B	Namusanga	10.4.07	Neg. blood....	No	B	9.4	C	10
603	B	Bwala....	11.4.07	Neg. gland....	No	D	12.3	C	8
617	C	Paulo	29.4.07	Neg. blood....	No	C	16.7	C	9
621	B	Bafirawala	7.5.07	Neg. gland....	No	B	16.2	C	5
632	B	Issia	14.5.07	Neg. blood....	No	B	7.4	C	3
638	B	Benwa	18.5.07	Neg. gland....	No	C	17.6	C	6

TABLE XXVI B.
Analysis of Cases shown in Table XXVI A.

Condition.	Class of Case.			Totals.
	A.	B.	C.	
Improved .... .... ....	....	....	1 (C to B)	1
In same state as on admission....	10	43	4	57
Worse	12	12	....	24
Total .... .... ....	....	....	....	82

From a later report made by Dr. Collyns on these and other cases on April 17th and 18th, 1909, a copy of which is inserted here, it will be seen that 82 cases were then alive, 4 absentees having returned for inspection, and that Dr. Collyns, who was familiar with these cases from their early stages, expresses, with much reserve, the opinion that 4 of these 82 cases and one other at the same camp may yet be cured, while 13 of these and 2 other early admissions were apparently well. 7 of these last having improved since November 30th, 1908.

I believe that this proportion of success is as great as that likely to obtain after a similar interval for any equal period up to November 30th, 1908, during which Sleeping Sickness has been treated in Uganda.

To take a still earlier period, of 222 cases admitted during the first quarter after treatment with atoxyl was begun, 122 were alive on February 29th, 1908, and 26 improved, while on November 30th, 1908, only 63 remained alive and none were reported as improved.

REPORT by Dr. J. M. Collyns, who was in charge of Busiro camp from August 10th, 1907, to April 3rd, 1908, of an examination of cases in this camp made on April 17th and 18th, 1909. The cases examined include all survivors from those enumerated in Table XXVI A—

I examined 131 cases, who were admitted before March 1st, 1909, and of these I consider the following, having regard to their present condition only, may be cured :—

No.	Class of Case on Admission.					Date of Admission.	Present Condition and Class of Case.	
1,301	B	....	....	....	....	12.12.06	A.	Slight tongue tremors. Well
1,415	A	....	....	....	....	4.1.07	A.	Slight pain in legs
1,431	A	....	....	....	....	31.12.06	A.	Well. Slight tongue tremors
1,262	A	....	....	....	....	7.3.07	A.	No symptoms
326	C (in lunatic asylum for months, a mere skeleton.)					30.6.07	A.	Perfectly well. Fat and strong

This last case is the most marked of the five and appears to be absolutely cured.

The following cases are apparently well at the present time but it is, I think, extremely doubtful whether they are permanently cured :—

No.	Class of Case on Admission.					Date of Admission.	Present Condition and Class of Case.
1,358	A	....	....	....	....	29.12.06	A. Slightly sleepy expression
1,379	B	....	....	....	....	31.12.06	A. Slight chest pain
1,393	B	....	....	....	....	3.1.07	? A. No symptoms
1,434	B	....	....	....	....	31.12.06	A. No symptoms
1,465	B	....	....	....	....	8.1.07	A. "
1,204	A	....	....	....	....	25.1.07	A. "
1,227	A	....	....	....	....	17.2.07	A. "
1,228	A	....	....	....	....	17.2.07	A. "
1,240	A	....	....	....	....	21.2.07	A. "
1,281	B	....	....	....	....	10.3.07	A. "
422	B	....	....	....	....	25.3.07	A. "
424	B	....	....	....	....	29.3.07	A. "
311	A	....	....	....	....	7.6.07	A.
651	A	....	....	....	....	30.7.07	A. Quite well except for semi-paralysis on one side

Remembering how many years it may be before the disease kills an untreated person, I do not consider that the majority of these cases have been under observation long enough for one to say that they are permanently cured ; knowing, as one does, how very often the most promising cases, who may have been well for months on end, are struck down suddenly, generally with some cerebral lesion, and die within a few days.

I have, &c.,

(Sd.) J. M. COLLYNS, Medical Officer.

Tables XVI to XXV show the results obtained by treatment with atoxyl only and with atoxyl and mercury.

As was pointed out by Capt. A. C. H. Gray, R.A.M.C., in his last quarterly report, which has been already referred to, the latter treatment was begun at least 6 months later than the former. In estimating results, therefore, it will be best to compare the statistics of the latter with those of the former as they stood 6 months previously. For example, the statistics for atoxyl and mercury on November 30th, 1908, should be compared with these for atoxyl only as they stood on May 31st, 1908, when the bulk of the cases would have been for an equal length of time under the respective forms of treatment.

By using this method of comparison it is found that the improvement rate under atoxyl only is the higher, while the death rate is also higher. Comparison of the statistics obtained from the administration of these two forms of treatment to patients admitted during the second year, throughout which both forms were used, shows similar results. (See tables XXXVIII to XLI.)

I have therefore come to the conclusion that it is very doubtful whether treatment by atoxyl and mercury offers any advantages over treatment by atoxyl alone.

TABLE XVI.

Showing condition at Various Dates of all Cases Admitted during the First Year and Treated with Atoxyl only.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	118	120	78	29
Relapsed	39	64	22	32
Continued in same state	155	15	51	58
Absent	61	89	70	56
Died	261	346	413	459
Totals....	634	634	634	634

TABLE XVII.

Showing condition at Various Dates of all Cases Admitted during the First Year and Treated with Atoxyl and Mereury.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	174	45	59	59
Relapsed	55	70	27	32
Continued in same state	130	122	76	41
Absent	70	95	125	136
Died	70	167	212	231
Totals....	499	499	499	499

From the figures given in tables XVI it follows that the improvement rate under atoxyl on February 29th, 1908, was 18.6% and the death rate 41%, and that on November 30th, 1908, the improvement rate had fallen to 4.5% and the death rate risen to 72%.

From the figures given in table XVII it follows that the improvement rate under atoxyl and mercury on February 29th, 1908, was 35% and the death rate 14%, while on November 30th, 1908, the improvement rate had fallen to 11.8% and the death rate risen to 46%.

On May 31st, 1908, the bulk of the cases treated with atoxyl only had been under treatment for the same length of time as had the bulk of those treated with atoxyl and mercury on November 30th, 1908.

Comparing figures on these respective dates we get:—Improved under

atoxyl only on May 31st, 18·9%, deaths 54·5%. Improved under atoxyl and mercury on November 30th, 11·8%, deaths 46%.

From tables XVIII and XIX, relating to A cases only, we get :—Improved under atoxyl only on May 31st, 29·4%, deaths 20·5%. Improved under atoxyl and mercury on November 30th, 13·3%, deaths 18·3%.

From tables XX and XXI, relating to B cases only, we get :—Improved under atoxyl only on May 31st, 25%, deaths 51·3%. Improved under atoxyl and mercury on November 30th, 11·7%, deaths 40·8%.

From tables XXII to XXV relating to C and D cases similar percentages are obtained.

TABLE XVIII.

Showing condition at Various Dates of all A Cases Admitted during the First Year and Treated with Atoxyl only.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	17	23	14	4
Relapsed	4	6	3	13
Continued in same state	42	1	8	14
Absent	3	32	35	26
Died	12	16	18	21
Totals....	78	78	78	78

NOTE.—140 A cases admitted during the first year.

78 treated with atoxyl only.

60 treated with atoxyl and mercury.

2 treated with other methods.

TABLE XIX.

Showing condition at Various Dates of all A Cases Admitted during the First Year and Treated with Atoxyl and Mercury.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	26	3	5	8
Relapsed	4	5	1	3
Continued in same state	9	20	16	6
Absent	19	29	29	32
Died	2	3	9	11
Totals....	60	60	60	60

TABLE XX.

Showing condition at Various Dates of all B Cases Admitted during the First Year and Treated with Atoxyl only.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	67	66	47	11
Relapsed	16	47	15	18
Continued in same state	89	10	35	38
Absent	17	6	5	5
Died	74	134	161	191
Totals....	263	263	263	263

NOTE.—517 B cases admitted during first year.

263 treated with atoxyl only.

230 treated with atoxyl and mercury.

24 treated by other methods.

TABLE XXI.

Showing condition at Various Dates of all B Cases Admitted during the First Year and Treated with Atoxyl and Mercury.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	82	22	29	27
Relapsed....	30	39	17	18
Continued in same state	63	56	34	22
Absent	29	44	62	69
Died	26	69	88	94
Totals....	230	230	230	230

TABLE XXII.

Showing condition at Various Dates of all C Cases Admitted during the First Year and Treated with Atoxyl only.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	34	24	17	12
Relapsed	17	10	4	1
Continued in same state	19	4	7	6

TABLE XXII—continued.

Showing condition at Various Dates of all C Cases Admitted during the First Year and Treated with Atoxyl only—continued.

Condition.	On Feb. 29th '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08
Absent	41	51	28	25
Died	125	146	179	191
Totals....	235	235	235	235

NOTE.—431 C cases admitted during first year.

235 treated with atoxyl only.

196 treated with atoxyl and mercury.

TABLE XXIII.

Showing condition at Various Dates of all C Cases Admitted during the First Year and Treated with Atoxyl and Mercury.

Condition.	On Feb. 29th, '08.	On May 31st, '08,	On Aug. 31st, '08.	On Nov. 30th, '08,
Improved	62	20	24	22
Relapsed	20	23	9	11
Continued in same state	58	46	24	12
Absent	22	22	34	35
Died	34	85	105	116
Totals....	196	196	196	196

TABLE XXIV.

Showing condition at Various Dates of all D Cases Admitted during the First Year and Treated with Atoxyl only.

Condition.	On Feb. 29th, '08.	On May 31st, '08	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	1	7	....	2
Relapsed	2	1	....	....
Continued in same state	5	....	1	....
Absent .... .... .... ....	....	....	2	....
Died	50	50	55	56
Totals....	58	58	58	58

NOTE.—97 D cases admitted during first year.

58 treated with atoxyl only.

13 treated with atoxyl and mercury.

26 untreated.

TABLE XXV.

Showing condition at Various Dates of all D Cases Admitted during First Year and Treated with Atoxyl and Mercuric.

Condition.	On Feb. 29th, '08.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	4	....	1	2
Relapsed	1	3	....	....
Continued in same state ....	....	....	2	1
Absent .... .... ....	....	....	....	....
Died	8	10	10	10
Totals....	13	13	13	13

Tables XXVII to XLII relate to cases admitted during the second year, from November 30th, 1907, to November 30th, 1908.

From table XXVIII it may be seen that there were in all 3,896 admissions, of whom 2,312 were from Buganda Kingdom, 1,556 from Busoga and 28 from other parts, while of the 2,312 from Buganda 1,407 were islanders and only 905 belonged to the mainland.

There is every reason to believe that the 905 admissions from Buganda mainland represent a far higher proportion of the total local infection than is the case with the numbers admitted from the islands and Busoga respectively.

The 28 admissions from the other parts were persons employed in and no doubt infected in the Lake Victoria epidemic area.

Table XXVII shows that of the total 3,896 admissions 609, or 15.6 %, were classed as A cases, 2,182 or 56 % as B cases, 927 or 23.7 % as C cases and 178 or 4.5 % as D cases.

During the first year 11.8 % of the admissions were A and 43.6 % B cases, so that during the second year the proportion of admissions in the earlier stages of the disease was more than maintained.

The stages of Sleeping Sickness represented by classes A, B, C, and D are the same as in former reports, namely:—A, those apparently in good health. B, those in whom there are early signs from which the existence of Sleeping Sickness may be reasonably suspected. C, those in whom clinical signs are well marked. D, advanced cases.

In future stages C and D will be classed together, since there seems to be no longer any object in differentiating between them.

TABLE XXVII.
Quarterly Admissions during Second Year in Classes.

			A.	B.	C.	D.	Total.
1st quarter	....	....	243	996	395	78	1,712
2nd quarter	....	....	109	471	164	42	786
3rd quarter	....	....	180	433	198	42	853
4th quarter	....	....	77	282	170	16	545
Totals	....	....	609	2,182	927	178	3,896

TABLE XXVIII.
Showing Place of Origin of all Admissions during the Second Year.

TABLE XXIX.

Showing Condition on November 30th, 1908, of all Classes of Cases Admitted during the Second Year.

Condition.	A.	B.	C.	D.	Totals.
Improved	33	323	203	19	578
Relapsed	52	129	18	....	199
Continued in same state	125	397	147	1	670
Absent	288	693	171	15	1,167
Died	111	640	388	143	1,282
Totals	609	2,182	927	178	3,896

Table XXIX shows the condition on November 30th, 1908, of all cases admitted during the second year. The percentage of improvement was 14·8 and that of deaths 32·9, and it will at once be seen on comparison with tables X and XV Δ that the improvement rate is far lower and the death rate far higher than that which obtained at the end of the first year.

Unfortunately serious famine prevailed in Busoga during the greater part of the year and not only did patients there bear with difficulty the normal doses of arsenical remedies but many died mainly of the effects of famine and many also of intercurrent diseases such as diarrhoea. Many cases also, especially in the first few months after the camp was opened, were admitted in an advanced stage of Sleeping Sickness.

In consequence the death rate at this camp was a little over 58 %, though the improvement rate was 10·7 %, which is not very far under the average for the year.

If we take Busoga and the other 3 camps separately for comparison we find the following rates of improvement and of deaths :—

Busoga camp, improved 10·7 %, died 58·3 %.
 Other camps, ,, 17·7 %, ,, 20·0 %.
 First year, ,, 45·0 %, ,, 19·0 %.

It is then seen that the death-rate, excluding Busoga camp, is about the same for the second as for the first year for all cases (Table XV Δ), but that the improvement rate is still much lower, although, as has just been stated above, the proportion of early cases admitted was higher during the second year.

For this result there appears at present no satisfactory explanation to offer; but it will be noticed that a very large proportion of cases are returned as absent, especially among the early cases (A and B classes), and it is possible that a proportion of these may have undergone some improvement, or might have done so had they persisted in their attendance for treatment.

As has been already recorded, the chiefs have stated their opinion that no native has yet been cured, and this opinion, being no doubt shared by the people generally, has no doubt so shaken their confidence in treatment that

the number of absentees has largely increased. As has also been stated above, a considerable number of the absentees are islanders, who, having come to the camps for treatment, have subsequently returned after receiving treatment whether this has been beneficial to them for the time being or not. The proportion of absentees from Busoga camp is small.

If we take A and B cases separately the percentages of improvement and deaths are found to be as follows :—

All camps, A cases, improved	5.4 %	died	18.2 %.
Busoga camp, "	1.5 %	"	41.9 %.
Other camps, "	7.3 %	"	6.8 %.
First year, "	62.8 %	"	3.5 %.

All camps, B cases, improved	14.8 %	died	29.3 %.
Busoga camp, "	12.3 %	"	50.2 %.
Other camps, "	16.8 %	"	11.7 %.
First year, "	51.4 %	"	7.3 %.

It will be seen therefore that what has already been said with regard to the cases generally applies also when the early cases are taken by themselves.

The death rate for Busoga is abnormally high, but the death rates at the other camps, although much smaller, are still considerably higher than those which obtained among early cases at the end of the first year, while the improvement rate is comparatively very low, and is not materially bettered by the exclusions of Busoga cases.

I believe that the classification of cases has been carefully made, and that the tendency has been, with increased experience, to place even fewer cases in the A class on admission than formerly. It is probably on this account that a lower rate of improvement is shown during the second year for A cases, since they cannot really be supposed to have materially improved until there appears to be a chance that they may be cured.

Tables XXX to XXXVII are intended to show the progress of A and B cases under treatment through the second year.

TABLE XXX.

A Cases Admitted during the Quarter ending February 29th, 1908, showing Condition on Various Dates.

Condition.					On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	....	....	....	....	100	42	9
Relapsed....	....	....	....	....	10	8	9
Continued in same state	....	....			63	109	26
Absent	....	....	....	....	43	47	155
Died	....	....	....	....	27	37	44
Totals	....	....	....		243	243	243

TABLE XXXI.

B Cases Admitted during Quarter ending February 29th, 1908, showing Condition on Various Dates.

Condition.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	473	442	134
Relapsed....	60	43	44
Continued in same state	180	129	96
Absent	87	120	413
Died	196	262	309
Totals	996	996	996

TABLE XXXII.

A Cases Admitted during the Quarter ending May 31st, 1908, showing Condition at Various Dates.

Condition.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	35	36	13
Relapsed....	6	7	15
Continued in same state	58	25	27
Absent	5	27	38
Died	5	14	16
Totals	109	109	109

TABLE XXXIII.

B Cases Admitted during the Quarter ending May 31st, 1908, showing Condition at Various Dates.

Condition.	On May 31st, '08.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	112	172	78
Relapsed....	24	17	37
Continued in same state	273	109	74
Absent	14	66	161
Died	48	107	121
Totals	471	471	471

TABLE XXXIV.

A Cases Admitted during the Quarter ended August 31st, 1908, showing condition at Various Dates.

Condition.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	10	10
Relapsed	7	15
In same state	77	28
Absent	51	79
Died	35	48
Totals	180	180

TABLE XXXV.

B Cases Admitted during the Quarter ending August 31st, 1908, showing Condition at Various Dates.

Condition.	On Aug. 31st, '08.	On Nov. 30th, '08.
Improved	72	66
Relapsed	20	28
In same state	106	62
Absent	88	99
Died	147	178
Totals	433	433

TABLE XXXVI.

Showing Condition of all A Cases Admitted during the Quarter ending November 30th, 1908.

Condition.	On Nov. 30th, '08.
Improved	1
Relapsed	13
In same state	44
Absent	16
Died	3
Totals	77

TABLE XXXVII.

Showing condition of all B Cases Admitted during the Quarter ending November 30th, 1908.

Condition.	On Nov. 30th, '08.
Improved	45
Relapsed	20
In same state	165
Absent	20
Died	32
Totals	282

The principal modes of treatment in use during the year were the administration of atoxyl only or atoxyl with mercury. Soamin is being more and more used in place of atoxyl. Its trypanocidal effects are at least equal to those of atoxyl while it appears to be slightly less toxic, so that it can be given in rather larger doses. This is no doubt a question of consistency in its chemical purity and stability.

The following were the methods of dosage used in the administration of atoxyl :—

1. (b) 0·4 grm. every 10th and 11th day.
2. (e) 1·0 grm. every 15th and 16th day.
3. (f) 0·6 grm. every 15th and 16th day.
4. The same as No. 3 but with an initial dose of 1 grm. In some cases an initial dose of ·7 grm. seems to have been used.
5. 0·2 grms. every 3rd day (Manson's method).

The letters (b), (e), &c., refer to Capt. Gray's Report for the Quarter ending February 29th, 1908, published by the Sleeping Sickness Bureau.

The methods most extensively used have been Nos. 1 and 3. Nos. 2 and 4 have been practically given up owing to the greater incidence of toxic effects following their use. No. 5 has not been employed for many months and is still under trial. As regards toxic effects the results have been favourable, but the trypanocidal effects appear to be less rapid and there would seem at present to be no better prospect of permanent cures by this than by other methods which have been used.

The following methods have been used in the administration of atoxyl and mercury :—

1. Atoxyl by method No. 1, 3 or 4 followed by one or more courses of Lambkin's mercurial cream, m.V once a week.
2. (k) Dr. van Someren's method :—1st day atoxyl 1 grm. between the scapulae and mercury perchloride ·01 grm. in the buttock, 2nd day atoxyl ·5 grm., followed by atoxyl ·5 grm. every 14th and 15th day with ·01 grm. mercury perchloride every 14th day. After 3 or 4 months the dose of atoxyl was latterly reduced to ·2 grm.
3. Atoxyl ·4 grm. every 10th and 11th day. Mercury perchloride ·01 grm. every 14th day.

4. After a 6 months course of atoxyl by method No. 1 a course of injections of soluble mercury salts repeated every 5 days.

At present it cannot be said that any one of the above methods has any special advantage from a curative point of view. Toxic effects occur more frequently where the larger initial doses of atoxyl are used. Salivation is more apt to result during the use of method No. 1 than the other methods. (See Appendix on the occurrence of eye-symptoms.)

Tables XXXVIII and XLII give a comparison of the results obtained from various methods of treatment, while Tables XXXIX, XL and XLI compare the results from treatment with atoxyl and with atoxyl and mercury.

It will be seen from Table XLI that the percentages of improvement under these two methods are about the same, while the death rate is considerably higher in the case of atoxyl.

This higher death rate is accounted for by the fact that in Busoga camp comparatively few cases (110 only) were treated with mercury, which it was found was tolerated badly by the emaciated patients received during the famine.

From Table XXXVIII we see that 1,834 cases were treated with atoxyl only and 1,422 with atoxyl and mercury. Of these cases 984 and 110 respectively belong to Busoga, so that more than half of the cases treated by atoxyl only were treated at Busoga camp, while 1,312 out of 1,422 cases which received atoxyl and mercury were treated at the other three camps, where conditions were favourable.

By taking the Busoga figures separately we can make comparison of results as follows :—

At all camps, improved under	$\left\{ \begin{array}{l} \text{atoxyl only, } 14.5\% \\ \text{with mercury, } 15.0\% \end{array} \right\}$	died	$\left\{ \begin{array}{l} 42.1\% \\ 21.9\% \end{array} \right\}$
At Busoga camps, , ,	$\left\{ \begin{array}{l} \text{atoxyl only, } 12.7\% \\ \text{with mercury, } 8.1\% \end{array} \right\}$	died	$\left\{ \begin{array}{l} 56.4\% \\ 76.3\% \end{array} \right\}$
Other camps, , ,	$\left\{ \begin{array}{l} \text{atoxyl only, } 16.4\% \\ \text{with mercury, } 15.6\% \end{array} \right\}$	died	$\left\{ \begin{array}{l} 25.6\% \\ 16.4\% \end{array} \right\}$

From the above comparison it is seen that, eliminating the Busoga cases, the improvement rate is not greatly altered, though that for atoxyl becomes slightly the higher, while the death rate for atoxyl, lowered from 42.1% to 25.6%, remains higher than that for atoxyl and mercury. The percentage results from the two methods of treatment are thus very similar to those for cases admitted during the first year.

TABLE XXXVIII.

Showing condition on November 30th, 1908, of all Cases Admitted during the Second Year under Various Methods of Treatment.

Condition.	Atoxyl.	Atoxyl and Mercury.	Other Methods.	Untreated.	Totals.
Improved	267	214	97	....	578
Relapsed	68	102	29	....	199
Continued in same state	235	206	229	....	670
Absent	491	600	58	18	1,167
Died	773	300	173	36	1,282
Totals....	1,834	1,422	586*	54	3,896

* See Table XLII.

TABLE XXXIX.

Showing condition on November 30th, 1908, of Cases Admitted during the Second Year Treated with Atoxyl only.

Condition.	A.	B.	C.	D.	Totals.
Improved	15	150	92	10	267
Relapsed	17	48	3	....	68
Continued in same state	43	145	46	1	235
Absent	152	247	86	6	491
Died	64	415	206	88	773
Totals....	291	1,005	433	105	1,834

TABLE XL.

Showing condition on November 30th, 1908, of Cases Admitted during the Second Year Treated with Atoxyl and Mercury.

Condition.	A.	B.	C.	D.	Totals.
Improved	11	118	76	9	214
Relapsed	26	66	10	....	102
Continued in same state	31	134	41	....	206
Absent	112	420	61	7	600
Died	25	119	102	54	300
Totals....	205	857	290	70	1,422

TABLE XLI.

Comparing Percentage of Improvement and of Deaths among early Cases Admitted during Second Year and Treated with Atoxyl and with Atoxyl and Mercury.

Condition on Nov. 30th, '08.	Treatment.	A Cases.		B Cases.	
		...	%	...	%
Improved	Atoxyl .... .... ....	...	5.1	14.9	
	Atoxyl and mercury ....	...	5.3	13.7	
Died	Atoxyl .... .... ....	...	21.9	41.2	
	Atoxyl and mercury ....	...	12.0	12.7	

TABLE XLII.

Showing condition on November 30th, 1908, of all Cases Admitted during the Second Year which were not Treated either with Atoxyl only or Atoxyl and Mercury.

Condition on Nov. 30th, '08.	Soamin.	Kharsin, alone or combined.	Atoxyl and Orpiment.	Atoxyl and Antimony.	Antimony.	Orsudan.	Arsacetin.	Untreated.	Totals.
Improved	36	26	24	1	....	3	7	....	97
Relapsed....	21	5	....	....	....	3	....	....	29
Continued in same state	198	2	6	1	....	10	12	....	229
Absent	21	28	3	1	1	2	2	18	76
Died	52	101	5	7	4	4	....	36	209
Totals	328	162	38	10	5	22	21	54	640

Table XXXVIII shows that, in addition to the cases treated either by atoxyl or by atoxyl and mercury, 54 remained untreated and 586 were treated by other methods. These figures are analysed in Table XLII.

Of the 54 untreated cases 18 deserted before treatment could be given and the remaining 36 were considered on admission to be beyond treatment.

Of the 586 other cases 348 were treated wholly or mainly with soamin. In constitution and action this drug appears to be the same as atoxyl, to which it is in no way inferior. But it seems no more likely to effect a cure in any considerable number of cases, since the statistics obtained from its use do not differ materially from those obtained by treatment with atoxyl, with which they will in future be combined.

Kharsin, either alone or combined with atoxyl, mercury, &c., was given to 162 cases, with most unfavourable results, as will be seen from the table.

This drug was in use only for a short time, its use having been discontinued as soon as the occurrence of severe toxic symptoms was reported from the camps. The details in connection with it have already been reported separately.

Under atoxyl and orpiment are shown 38 cases of which 24 are improved and 5 are dead. This form of treatment has so far given favourable results and is being given an extensive trial, but, as it has only been in use about 5 months, it is too early to form a definite opinion as to its ultimate value.

Treatment by atoxyl and antimony has not at present shown favourable results. Both antimony cream and solution of tartar emetic have been given by injection, but are both very painful. Alternate and simultaneous treatment by antimony and atoxyl are being more extensively tried, the antimony being generally given, in the first instance, by intravenous injection.

Treatment by antimony alone has not been successful and does not seem to be effective for any length of time. It has therefore been discontinued.

Orsadan was used in 22 cases but did not seem to possess any advantages over soamin.

Arsacetin was given in 21 cases. It does not appear to have so rapid a trypanocidal effect as soamin and atoxyl and it seems to produce toxic symptoms as readily as either.

The methods of dosage used in the above methods of treatment were as follows :—

Soamin was given in much the same manner as atoxyl, the doses being generally slightly larger. The dosage most used was .5 grm. every 10th and 11th day, or 1 grm. on two successive days followed by .5 grm. every 14th and 15th day.

The dosage used in giving Kharsin was detailed in the special report on this drug.

In giving atoxyl and orpiment Laveran's method was used.

Antimony was given in an initial dose of $\frac{1}{16}$ grain followed by $\frac{1}{8}$ grain every 10th and 11th day.

Orsudan was usually given in 1 grm. doses every 15th and 16th day; also .5 grain every 10th and 11th day.

Arsacetin (Ehrlich) was given in doses of .6 grm. repeated every 7th and 8th day.

Judging from the results set forth in this report and from the experience recorded by others it was deemed advisable early in this year (March, 1909) to discontinue the administration of organic arsenic indefinitely or for prolonged periods and the course of treatment by it is now limited.

Treatment by organic arsenic is now either combined with or followed by courses of antimony or inorganic arsenic or both.

After a short course by intravenous injection of the former, the duration of further courses by the mouth both of it and of inorganic arsenic is left to the discretion of the Medical Officers in charge of the camps.

The other conclusions which have been formed with regard to the camps and the treatments used have been already stated at the commencement of this report, and to them I have at present nothing further to add.

APPENDIX A.

BLINDNESS OR VISUAL DEFECT FOLLOWING THE USE OF ATOXYL AND ITS ALLIES.

Cases of defect of vision or blindness following the use of Atoxyl and allied drugs have occurred less and less frequently until at present they are quite exceptional.

It will be sufficient and will save needless complexity to give here details of the cases which have occurred in one of the camps, from which the details obtained from the other camps do not materially differ.

In Chagwe camp defect of vision has been noted in 64 patients altogether, out of a total of 831, showing an incidence of 7.7 %. Blindness has occurred in 1.2 %.

The following table shows the method used in these cases and the maximum dose of the drug which was given in each :—

TABLE XLIII.

Treatment.	Maximum dose in grammes.							Totals.
	1.0.	0.8.	0.7.	0.6.	5.5. (Sic)	0.5.	0.4.	
Atoxyl....	2	....	....	....	....	....	4	6
Atoxyl with mercury....	13	....	9	18	1	3	2	46
Soamin....	6	5	....	....	....	....	....	11
Orsudan....	1	....	....	....	....	....	....	1
Total....	22	5	9	18	1	3	6	64

This table seems to show that the incidence was greater on those cases which received the larger maximum doses. Only 9 of the 64 received a maximum dose greater than .5 gm. and of these all but 3 were slight cases.* The larger incidence on cases treated with atoxyl and mercury is probably accounted for by the fact that the larger maximum dose of atoxyl was used more frequently in cases treated by the combined method. It is noteworthy that though soamin was given in maximum doses of 1 grm. and .8 grm. in a considerable number of cases, blindness followed in only one and serious visual defect in only two.

The duration of treatment before defect of vision was noted varied from 2 weeks (in one case) to 10 months, and the average duration was about 5 months.

Of the 64 cases 10 had become totally blind, 3 were nearly blind, 7 were classed as marked cases and 11 as slight cases, while 12 of the milder cases had recovered normal vision.

The following table shows details of the totally blind cases:—

TABLE XLIV.

Treatment.	Maximum dose in grammes.						Totals.
	1.0.	0.8.	0.7.	0.6.	0.5.	0.4.	
Atoxyl.... .... ....	....	....	....	....	....	1	1
Atoxyl with mercury....	2	....	2	3	1	....	8
Soamin....	1	....	....	....	....	....	1
Totals....	3	....	2	3	1	1	10

* This statement does not correspond with Table XLIII, in which there appears to be an error. Should *smaller* be read for *greater*?—Ed.

The following table shows the details of cases nearly blind or with marked visual defect :—

TABLE XLV.

Treatment.	Maximum dose in grammes.						Totals.
	1·0.	0·8.	0·7.	0·6.	0·5.	0·4.	
Atoxyl	1	....	....	....	....	1	2
Atoxyl with mercury....	4	....	....	1	....	....	5
Soamin....	2	....	....	....	....	....	2
Orsudan	1	....	....	....	....	....	1
Totals	8	....	....	1	....	1	10

APPENDIX B.

It has been stated in the course of this report that the exceptionally high death rate at Busoga camp was due to the famine-stricken condition of many of the patients.

Owing to the state of malnutrition induced by scarcity of food and unaccustomed diet, these people were not only rendered intolerant of treatment by arsenical, mercurial and other drugs but they became unusually susceptible to intercurrent disease, and there is reason to believe that the intestinal parasites, especially ankylostoma, which are carried by a large percentage of them, under ordinary circumstances, without noticeable disease or inconvenience, must have contributed largely to lessen their powers of resistance.

Dr. C. J. Baker and Lieut. A. D. Fraser, R.A.M.C., found that a very large percentage of the patients in Busoga were infected with ankylostoma. On one occasion, in 26 stools of patients taken at random, ova of intestinal parasites were found as follows :—

24 stools or 92%	contained ankylostoma.
9 "	34% trichocephalus dispar.
7 "	27% asearis lumbrieoides.
4 "	15% strongyloides intestinalis.
1 "	4% bilharzia.
2 "	8% no ova.

The condition of many of the patients received at Busoga camp during the famine was such that little could be done to improve matters by vermicidal treatment. Capt. A. C. H. Gray, R.A.M.C., while in charge of Chagwe camp was able, by energetic use of vermicides, to improve materially the general condition of many of his patients.

The drugs used were thymol, eucalyptol and beta naphthol, the last-named appearing to be the most useful.

It would seem advisable to make a routine practice of examining natives, and treating them whenever necessary, for internal parasites, in order to place them under the best conditions for experimental treatment by potent drugs during a chronic weakening disease such as Sleeping Sickness.

APPENDIX C.

THE BREEDING-GROUNDS OF GLOSSINA PALPALIS.

SESSÉ S.S. CAMP.

27th June, 1909.

To,

THE PRINCIPAL MEDICAL OFFICER,
UGANDA.

SIR,

I have the honour to inform you that on the 26th instant on the South-Eastern shore of Fort Stanley (Martin's shamba), under a large tree (leaves of which are forwarded herewith), which stands out slightly from the dense forest which borders the lake there and which runs to within about four yards of the water's edge, I found in two or three minutes 15 empty glossina pupal cases. The tree had a clear stem for about 15 feet and is one of those that look as if they had grown out of the ground, giving off roots which radiate in different directions before going underground. In an area not larger than one sq. ft., under the stem and between the large roots, the cases were found, along with a few broken up, withered leaves, lying on the surface of the soil which consisted entirely of dry, loose, rather coarse, white sand. No cases were found on the tree or under the surface of the soil, and all those found appeared as if the fly had emerged normally.

There was no slope and the situation was not more than one foot above water level. The shore and foreshore in the neighbourhood were sandy and are shaded—not to a great extent—by the tall forest trees, the same variety of tree as that under which the cases were found being the common one on the locality. The water at the edge of the lake was clear and open. The situation does not seem to be specially well sheltered, being quite exposed to the south-east winds.

On the 27th, I found, in little over half an hour's time, over 100 empty cases and 8 occupied ones. The majority of the former were found on the surface, the majority of the latter under the surface and within a few inches of it, although a few of them were found exposed. In most of these occupied cases, however, the pupae seem to have perished.

All were found within a yard or two of the edge of the forest, from two to four yards from high water mark and not more than fifty yards from the place where cases were found on the 26th. Further along the shore and within the forest have not yet been searched. The conditions as regards shade, soil, &c., are the same as those mentioned above.

About half the number found were picked up in a few minutes from under a much decayed log of wood, which lay on the ground and projected from the forest on to the shore. Here a considerable amount of decayed vegetable matter was mixed with the sandy soil, which, therefore, was more moist than in other situations, and the majority of cases showed evidence of the pupae having been destroyed by the attacks of some insect which had entered the case through a small opening, the end of the case at which the young fly ought to emerge remaining intact.* No such insect was observed. One empty case was found lying exposed on the log. No others

* The small opening was probably that by which the insects had emerged, not entered.—ED.

could be found by erumbling up the deeayed wood. There was again no slope where these pupae were found.

The others were got at frequent intervals along the shore. At some plaees none would be found, while at others they were seen, without there being any apparent reason for the patehy distribution.

It would be useless to try to draw any eonelusions from the above, but it may safely be said that slope is not an essential eharaeteristic of breeding grounds.*

The pupae were so readily found, and I had previously so often looked in vain—usually along the northern shore of the peninsula—in plaees that, aecording to Bagshawe's aceounts of his diseoveries, suggested themselves as being likely ones in which pupae might be found, that it seems probable that the breeding grounds will be found to be limited to certain parts of the shore. If so, their presence might be indicated by finding the relative proportion of male and female flies caught at different places along the shore. The usual proportion brought from Fort Stanley by fly-boys is 10 males to 1 feinale. These, however, are caught in the forest several hundred yards from the water's edge. To-day I caught flies near where I had found the pupae and the proportion worked out at 2 males to 1 female, but the total number of flies caught was small, the day being eloudy. Before anything definite can be said, the limits within which pupae can be found will have to be ascertained.

Food supply cannot be abundant in the neighbourhood, and a few croeodiles, †Spele's gazelle and an oecasional hippo are found near. Natives have for long been prohibited from wandering into the peninsula, and as there is nothing there to attract them they praetieally never go. The edge of the lake here is not frequented by fishing eanoes.

I saw no evidence of birds having fed in the neighbourhood where the pupae were found. There are no guinea fowls.

The pupae have already been forwarded you.

I have, &c.,

(Sd.) A. D. FRASER.

SESSE S.S. CAMP.

25th July, 1909.

To,

THE PRINCIPAL MEDICAL OFFICER,
UGANDA.

SIR,

We have the honour to forward herewith a report on matters relating to breeding grounds of " Fly," &c.

On the 27th June one of us (A.D.F.) reported having found pupae deposits on the south-east shore at Fort Stanley and the following remarks apply to work sinee done in this eonnection. Pupae have now been found to be present almost eontinuously along 300-400 yards of shore; in faet as far as the conditions mentioned extend. It was pointed out that they were most readily

* Hodges wrote in 1908:—It is apparently an essential condition for breeding-plaees that there should be a well defined upward slope from the water's edge.—ED.

† Probably a typist's error for Speke, in which case *Tragelaphus spekei* is meant.—ED.
(12124)

found on the shore within a yard or two of the edge of the forest. It has since been found that the nearer the forest the more plentiful they are and usually the higher is the proportion of occupied cases, and that the most favourable place is close to the undergrowth that edges the forests—in the loose dry sand near the roots of the ferns, &c., and shaded to some extent by the tall forest trees.

In these situations they are usually to be found in considerable numbers—one of us with the help of a native boy picked up 60 full and 72 empty cases in an hour, six full ones being found in one handful of sand. As regards the relative proportion of occupied to empty pupae found in these places, leaving out of count one spot where over 100 deposits were found of which only 3 were occupied, the numbers of intact deposits (over 300 counted) has been almost exactly the same as that of the empty ones.

It will be remembered that the great majority of those first found were empty, 115 in 123. It was at first thought that this proportion might be due, as suggested in Bagshawe's discoveries, to this being the dry season. It is now, however, evident that this proportion is not the true one, and that the explanation must be looked for in some other direction. It is also seen that the relative proportion of empty cases may vary enormously at any one place and at the same season. Most of those first found were under a much decayed log of wood, and many showed evidence of having been destroyed by the attacks of insects, while those mentioned above in which only 3 in 100 were occupied were found in one spot. So that it does not seem unlikely that the large numbers there found, and the high proportion of empty cases, may be accounted for by the pupae having been collected there and destroyed by some insect.

Only after a considerable amount of searching and then only in small numbers at two places were pupae found along the north shore of the peninsula, although the physical conditions in many places appeared similar to those present where pupae had been found on the south-east shore. This shore is at this season fully exposed to the heat of the sun during the whole day and the sand was found to be much warmer to the touch, and the two places where pupae were found were the ones at which the shore was best shaded by overhanging trees. This would seem to indicate that the amount of shade that gives sufficient protection at one place may be inadequate at another and that the necessary amount may vary to some extent with the aspect.*

On the 10th July pupae were found on the small uninhabited island called Lunguru lying to the south-west of Bugala.

It was thought that pupae might be found in places where the physical conditions appeared to be the same as those at Fort Stanley, and to try to come to a conclusion on this point we arranged to go round the half of the island called Bunyinga and to search at places that seemed to indicate that they might be breeding grounds.

On the south side a search was made at two places. In one, a small sandy beach between rocky points, pupae were soon discovered. At the other the attacks of ants and fly drove us off before a search had been well started.

* This work was done in July when, since Sesse is on the equator, the north shore would get the sun's rays all day. Possibly between September and March, when the sun is in the south, the pupae would be found on the north shore rather than on the south.—ED.

It may then be said that breeding grounds may be recognised by the physical conditions, and it might here be mentioned that we have often observed that fly on these islands are most numerous in localities where the shore is sandy.

The following remarks apply to the physical condition at localities where pupae have been found and which may have some bearing on their deposition:—

1. *Soil*.—Has always been sandy and easily turned up with one's fingers. Except at Lunguru, where the upper three inches were damp but dry underneath, the soil has been dry.

2. *Shade*.—The amount of shade has varied to a considerable extent at different localities. At some places it appeared to be much less than we would have expected. The grounds to the south-east of Fort Stanley are in many places quite unprotected from the sun's rays till about 11 a.m. Those at Bugoma, Bungo and Lunguro were shaded by small bushes only.

3. *Trees*.—Deposits have been found in places shaded by many varieties of trees and bushes and we have seen no reason for supposing that any variety of tree or shrub favours their deposition. But, as suggested by you, it would be most useful to find a tree that would be antagonistic to the fly or its breeding grounds and, as this apparently can only be done by a process of exclusion, it would be well to know trees, &c., under which pupae have been found. We will, therefore, send you leaves, &c., for identification.

4. *Slope*.—We are convinced that slope is not essential. It has not been a marked feature at any of the places where we have found pupae.

5. *Distance* from high water mark at which deposits have been found has never been more than 15 yards. The usual distance has been 5 yards.

We intend now to search particularly in places along the shore where the conditions are different from those mentioned above.

A considerable amount of work has been done with a view to ascertain whether or not the presence of breeding places could be recognised by the relative proportion of male to female flies found at various points along the shore. At the breeding grounds to the south-east of Fort Stanley, of 300 fly caught there were three males to every female. The proportion, however, varied greatly on different days, and at different times of day—sometimes the females were in excess of males, while at other times the males were four times as numerous as the females. The largest proportion of females were usually found in the forenoon.

At another place, where pupae were thought not to be present, but were afterwards discovered, the proportion of males to females was 2-1, but here again it varied greatly at different times. The main difficulty in connection with any experiments that have any relation to breeding grounds is to find a place at which one can be certain there are no pupae.

While trying to ascertain the sex proportion flies were also marked on the lines laid down by Bagshawe.

100 fly were caught and marked at the breeding grounds to the south-east of Fort Stanley (hereafter called A) and released at the same spot. Another 100 were caught, marked and taken to a spot B over half a mile distant. At B 100 flies were marked and taken to A, another 100 being marked and released at B. There is continuous forest along the shore between A and B, but there is no traffic along the shore that might convey the flies from A to B.

Only ten of these marked flies have as yet been recaptured but those have been caught at the place at which they were released.

We have, &c.,

(Sd.) A. D. FRASER.

(Sd.) CLAUDE H. MARSHALL.

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